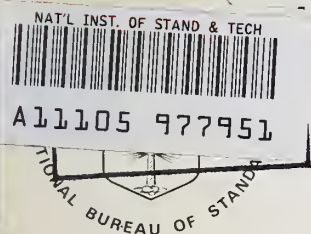


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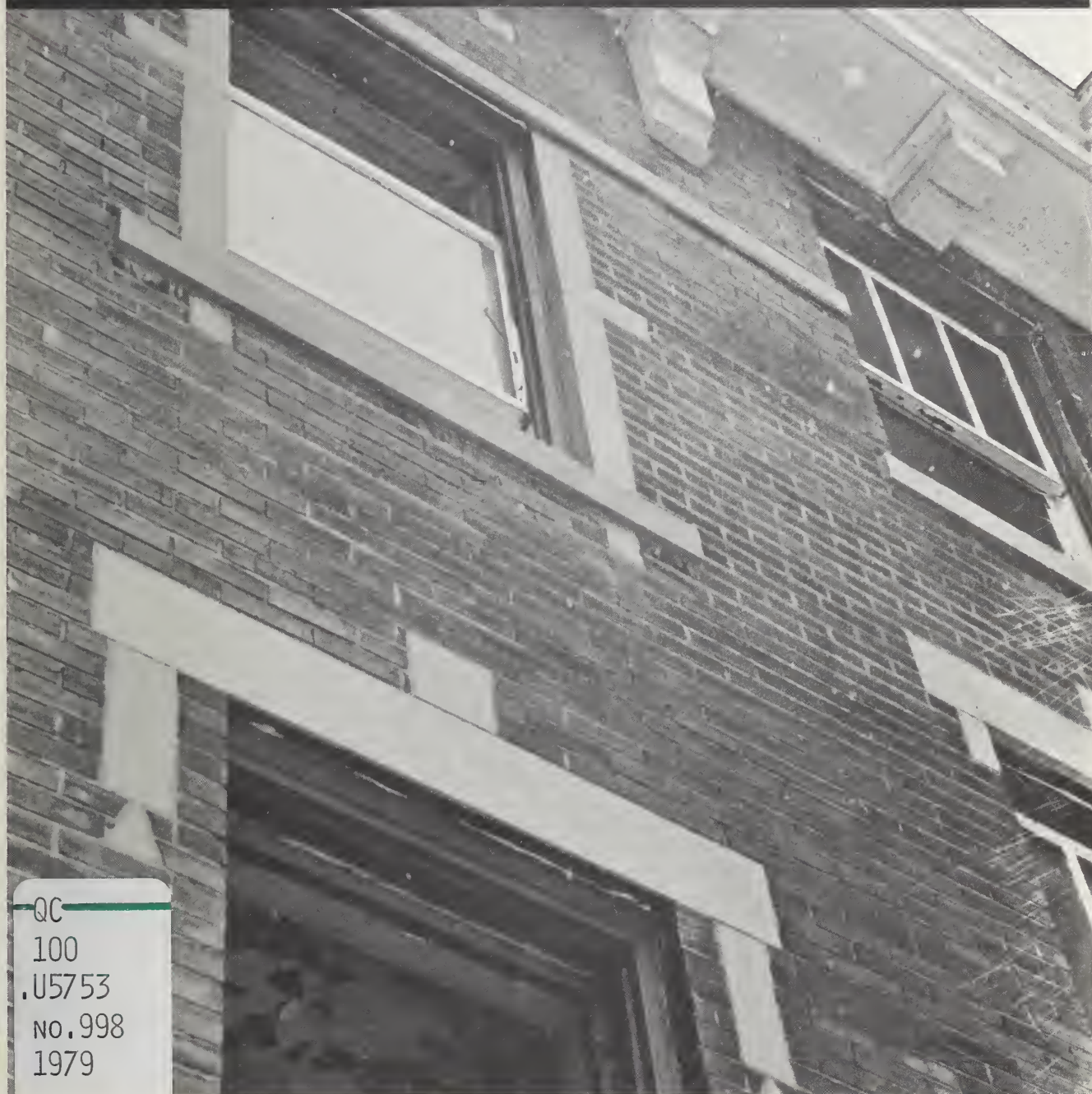
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Impact of Building Regulations on Rehabilitation — Status and Technical Needs

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards



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Impact of Building Regulations on Rehabilitation— Status and Technical Needs

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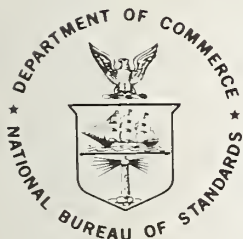
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TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENTS	iii
ABSTRACT	vi
1. INTRODUCTION	1
1.1 Impact of Building Regulations on Rehabilitation	1
1.2 Regulations Relative to Building Construction and Maintenance	5
1.3 Status of Previously Developed Building Rehabilitation Codes	7
2. REVIEW OF SOME RECENT STUDIES RELATIVE TO THE IMPACT OF BUILDING REGULATIONS ON REHABILITATION	9
2.1 "Information Structure of Building Codes and Standards for Needs of Existing Buildings" by Baird Smith	9
2.2 "Building Codes: Preservation and Rehabilitation" by Robert J. Kapsch	11
2.3 "Survey of Building Code Provisions for Historic Structures" by Melvyn Green and Patrick Cooke	14
2.4 "Urban Housing Rehabilitation in the United States" by Nathaniel Rogg	16
2.5 "New Approaches to Urban Housing" by U.S. League of Savings Associations	18
2.6 "An Investigation of Regulatory Barriers to the Re-Use of Existing Buildings" by Massachusetts Institute of Technology	19
2.7 "Assessment of Current Building Regulatory Methods As Applied to the Needs of Historic Preservation Projects" by National Trust for Historic Preservation	21
3. STUDY OF REGULATORY NEEDS FOR BUILDING REHABILITATION	23
3.1 Questions Addressed	23
3.2 Model Building Code Study	24
3.3 State and Major City Study	25
3.4 Synthesis of Study Results	29

	PAGE
4. REHABILITATION TECHNOLOGY PROGRAM	33
4.1 Technical Basis for Regulations and an Improved Regulatory Process	33
4.2 Development of New Technology and Evaluation Tools . . .	35
4.3 Development of Responsive and Cost-Effective Decision Tools	37
5. SUMMARY	38
REFERENCES	39
APPENDICES	41

Abstract

This report presents the results of a study of the impact of regulations on building rehabilitation and includes a discussion of the activities of the Building Rehabilitation Technology Group of the Center for Building Technology. Particular activities discussed relative to existing buildings include: (a) development of the technical bases for regulations and an improved regulatory process, (b) development of new technology and evaluation tools, and (c) development of responsive and cost-effective decision tools. A new code concept is outlined which could be a replacement for the "25-50 percent" rule presently in codes for new construction. This rule often controls the amount of work that may be required in the rehabilitation of existing buildings. The status of existing code documents for building rehabilitation is provided along with an overview of other publications which discuss the impact of building regulations on rehabilitation.

Key Words: Building code; building research; code administration; existing buildings; model codes; preservation; regulation; rehabilitation; renovation.

1. Introduction

Throughout the United States, increasing concern is being expressed for the need to more fully utilize the existing building stock. This concern is motivated by resource shortages and the increasing cost of most materials and products used in the construction of new buildings. Additionally, the costs of land, utilities and financing have added significantly to these higher costs. In the aggregate, these costs have risen much more rapidly than the general cost of living in recent years. The effects contribute to the fact that the new construction sector, even in good years, does not provide for the Nation's building needs. Also, more than one-half of the 71 million homes in the United States are 25 years old or older. As recently as 1973, 18 percent of the dwelling units were identified as having one or more serious deficiencies.

In the formulation of new national goals, President Carter and the Congress have called for greatly increased emphasis on rehabilitation of existing housing to rebuild the Nation's neighborhoods. Existing buildings and neighborhoods are viewed as contributing unique amenities that are not available through new construction. These amenities include architectural features, site characteristics and other unifying features which provide "roots" for an increasingly "rootless" America.

1.1 Impact of Building Regulations on Rehabilitation

There are many forces at work which potentially impede the full utilization of existing buildings. Market forces, financial considerations, governmental policy, industry structure, and regulatory activities are but a few. The main thrust of this report deals with a programmatic strategy for mitigating those adverse policies and practices that are present in our building regulatory processes which discriminate against the rehabilitation of existing buildings.

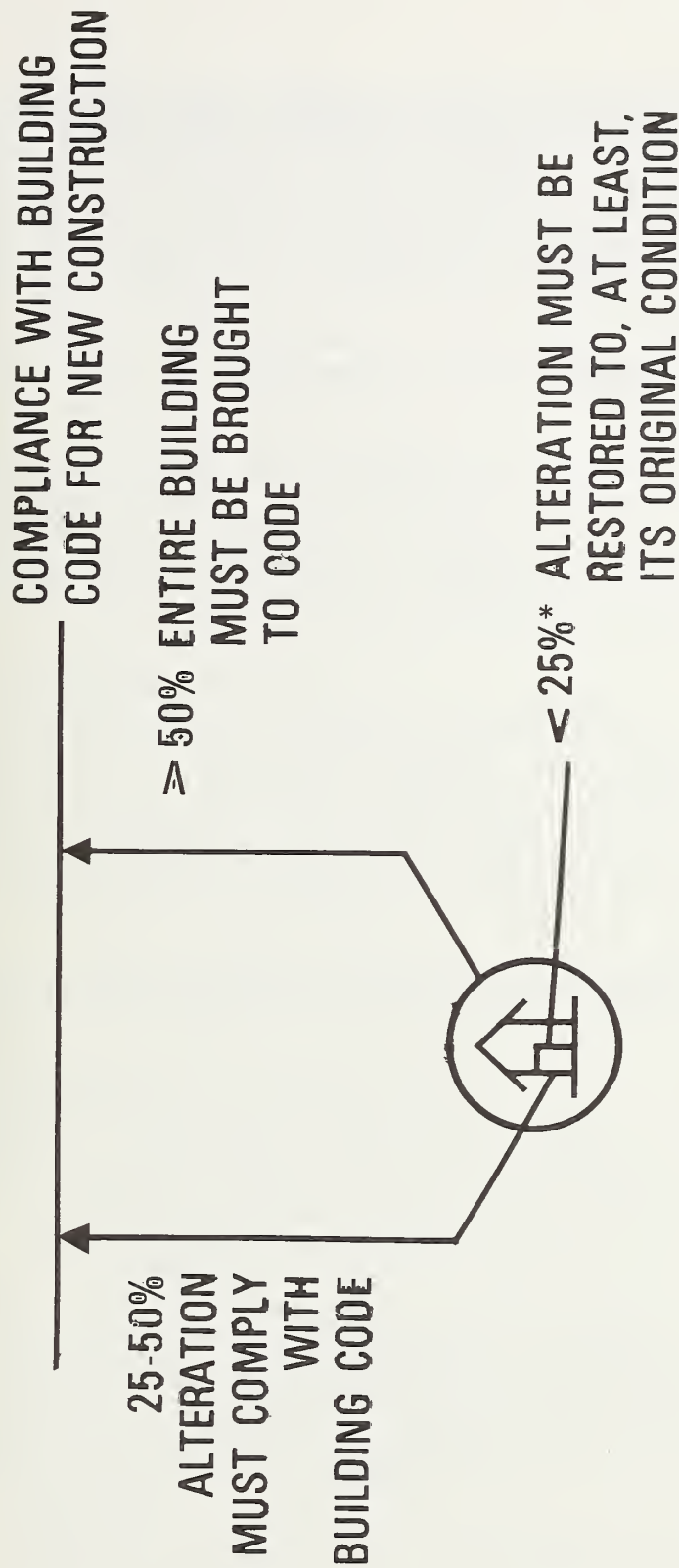
The prime regulatory avenue for assuring the minimum requirements for public health and safety in new building construction is the building code. However, building regulations specifically prepared to address the upgrading of existing buildings to acceptable levels of health, safety and serviceability currently do not exist. This is due, at least to some degree, to a lack of technical data and knowledge relative to existing buildings. Building codes and their enforcement have been identified as sources of constraint by developers, building owners, housing officials, and others, based on experience with projects involving the recycling of entire neighborhoods as well as rehabilitation of single buildings. The reasons cited include:

1. Inflexible requirements for compliance with current codes increase costs. Most codes contain provisions, variously worded, requiring that a building's conformance with the requirements of a currently enforced building code for new construction should increase in relation to the dollar amount of rehabilitation planned. An example is the requirement generally known as the "25-50 percent rule." Appendix A contains these provisions from the nationally recognized model building codes and Figure 1 depicts the general application of the rule. The application of these administrative provisions is based on the following economic hierarchy, which is itself awkward and difficult to enforce in actual practice:

- o the alteration must be restored to at least its original condition for a renovation which costs less than 25 percent of the value¹ of the building, or
- o the alteration must comply with the building code for new structures when the cost is between 25 and 50 percent of the building's value, or
- o the entire building must comply with the building code for new construction when alterations exceed 50 percent of the building's value.

These provisions are difficult to enforce at the local level, and may have negative effects on both public safety and the quantity and quality of the building stock. This is because there is a considerable period of time during which a building is not worth the expense of rehabilitation under current codes for new buildings but is not sufficiently hazardous to justify condemnation and demolition. Application of such administrative provisions merely extends the life of many nonconforming buildings in urban areas which then contribute to many of the social and economic ills of our society. Moreover, building deterioration is typically not confined to an individual structure; it has an area-wide effect with accompanying social, political, and economic problems, especially in cities.

¹The definition of "value" is not standardized. It has been interpreted as assessed value, market value, or replacement cost.



* Percentages refer to cost of rehabilitation related to value of the structure before rehabilitation

Figure 1 - Application of 25-50 Percent Rule

2. Present codes and standards may not address the types of construction represented in many older buildings. Approved construction assemblies may be dropped from a building code or reference standard, not because they are undesirable but because they are no longer part of the current catalog of construction materials and techniques. Construction elements of vintage structures may, in fact, meet or even exceed performance levels provided by current construction. Once a building assembly or construction technique is deleted from the code, it may be disapproved for continued use in rehabilitation, even though it meets the intent, but not the letter, of the code. This situation occurs frequently in the area of fire resistance. Fire testing of construction assemblies has been performed in essentially the same way for many years. However, as materials become obsolete (e.g., wood lath) they cease to be listed in many new code editions. Unless such assemblies have deteriorated, there is no reason to believe that they will not perform as previously rated and approved for use.
3. Building codes apply to new construction and are designed for that purpose. The language and format of building codes for new buildings tend to delineate and model the construction process with appropriate regulatory controls; i.e., a synthesis process, as contrasted to the analytic process needed in building rehabilitation. These codes tend to be less effective, or even inappropriate, when applied to the analysis process required to determine rehabilitation needs of existing structures.
4. Nature of current codes limits innovative solutions. Although all the model building codes and most of the codified documents based on these models contain a clause stating that alternate materials and methods of construction are not excluded from consideration, the majority of building officials hesitate to approve innovative systems because they often lack a technical basis upon which to make such decisions with regard to safety, health, level of performance, etc. Consideration must be given to the potential legal liability which building officials may be assuming when innovative systems are approved without adequate technical guidance or regulatory precedence of acceptance.
5. Code enforcement process for existing buildings differs from that for new buildings. Some enforcement agencies have established ad hoc processes to administer and enforce the code requirements for new buildings to existing building additions and alterations. Many local agencies attempt to force rehabilitation projects into a mold established for new building construction, thus increasing the difficulty of developing acceptable rehabilitation design solutions in the field.

These frequently imposed regulatory barriers make building rehabilitation projects expensive, difficult, and in some cases impossible. This study of needs and issues concerning building codes and rehabilitation was initiated in order to identify the ways in which the National Bureau of Standards' Center for Building Technology (CBT) can contribute to the reduction or elimination of undesirable regulatory constraints to building rehabilitation.

1.2 Regulations Relative to Building Construction and Maintenance

Governmental regulation of building construction is a consequence arising from the experience of centuries, in all civilized lands, of tragedies brought about by fire, collapse and panic. The primary intent of building regulations is to provide reasonable controls for the construction, use and occupancy of buildings. Properly written codes contain provisions requiring that buildings and structures be designed, erected and maintained in a manner which reduces risk to human life and safety to an acceptable level.

While the United States Constitution gives the authority for building regulation as one of the police powers to the States, the enactment, administration, and enforcement of building codes and regulations traditionally have been a function of local government. However, there have been an increasing number of programs and activities at both the State and Federal levels of government which have a direct impact on building codes and the regulation of various forms of building construction. These range from the adoption of various types of statewide building regulatory programs in a number of States to the promulgation of mandatory Federal Mobile Home Construction and Safety Standards.

Despite developments at the State level toward code uniformity within individual States and advances in the performance approach for establishing building requirements, the form and content of building regulations, as well as the attendant administration and enforcement activities, vary widely among municipalities and States. [1]²

Today there are approximately 14,000 individual communities in the United States issuing building permits on the basis of authorizing construction within their defined boundaries. Many of these jurisdictions have rules and regulations related to buildings which may or may not be comprehensive building codes covering all aspects of construction and occupancy. Actually, some jurisdictions are using only a fire prevention code to regulate building construction, while others have no codes at all.

²References are listed at the end of report.

The typical building code regulates the construction, alteration, maintenance, repair and demolition of buildings and structures. It may or may not regulate the installation and maintenance of mechanical systems and equipment within or appurtenant to buildings and structures. Many experts look upon the entire complex of regulatory codes, including electrical, plumbing, heating, boilers, pressure vessels, air pollution, air-conditioning, refrigeration, elevators, and flammable liquids as integral parts of the comprehensive building code.

Except for some of the large cities and a few States that develop their own, drafting of building codes in the United States is generally accomplished by the model code organizations. The National Building Code [2] is prepared by engineers of the American Insurance Association with assistance from many sources. Three other model code organizations each have regional spheres of influence. Their membership is comprised of local and State government code enforcement officials, industry representatives, and construction and design professionals. These three code making bodies are:

BOCA - Building Officials and Code Administrators
International, Inc.
Homewood, Illinois
(Basic Building Code [3])

ICBO - International Conference of Building Officials
Whittier, California
(Uniform Building Code [4])

SBCC - Southern Building Code Congress International, Inc.
Birmingham, Alabama
(Standard Building Code [5])

Basically, housing codes are maintenance codes which also regulate the environmental factors of residential buildings and, in the case of rental property, the facilities that must be supplied by the landlord. They are distinct and separate from building and other construction codes. These differences are not generally appreciated nor well understood by many who use the terms "housing" and "building" code synonymously. Such interpretations fail to recognize that the principal purpose of a building code is to require buildings to be designed and constructed in such a way as to safely sustain the loads expected from a specific type of occupancy and to be reasonably safe for such occupancy against fire and similar hazards. In contrast, the primary intent of a housing code is to establish minimum standards essential to maintaining dwellings safe, sanitary, and fit for human habitation.

Housing codes are also different from building and other construction codes in that the latter codes are enforced primarily through a system of building permits. These permits are granted after plans and

specifications have been submitted and evaluated. Field inspections of the work are conducted during construction and prior to occupancy. A governmental agency has control of the process through its authority to issue and withhold the required permits for construction and occupancy.

Primarily building and construction codes regulate how people build; housing codes regulate how people live. Building and construction codes are basically technical standards dealing with inanimate objects. On the other hand, because housing codes regulate how people may live, there are important social, economic, cultural, and psychological aspects which pertain not only to the basic requirements, but also to the administration and application of the provisions of the code.

The enforcement process for housing codes varies from city to city. The process is generally not rigid and inspectors exercise judgment in the process. The model building code organizations develop model housing codes which are adopted by many jurisdictions. These include the Uniform Housing Code [6], the Standard Housing Code [7], and the Basic Property Maintenance Code [8]. The first model housing code was developed by the Public Health Service of the U.S. Department of Health, Education and Welfare (HEW) [9] and was used as a basis for those which followed.

1.3 Status of Previously Developed Building Rehabilitation Codes

To date, there have been only limited attempts to formulate code provisions peculiar to rehabilitation needs. The following is a brief discussion of three such documents which address the subject in a somewhat restricted manner.

1.3.1 Guidelines for HUD Rehabilitation Projects

Guidelines setting forth basic objectives and provisions specifically related to building rehabilitation have been issued by the U.S. Department of Housing and Urban Development Federal Housing Administration (HUD-FHA) for use under various HUD-FHA mortgage insurance programs dealing with property rehabilitation. These HUD guidelines [10] contained in Handbook 4940.4 entitled "Minimum Design Standards for Rehabilitation for Residential Properties" were originally issued in September 1973. Several additions (e.g., provisions for handicapped, elderly, lead-based paint hazards and earthquake hazards) and certain changes (e.g., to fire protection and life safety provisions) were made to the Handbook and incorporated in later versions.

The guidelines apply to the physical rehabilitation of existing residential properties, from single family dwellings to large multistory, elevator-type apartment buildings, in all HUD field office jurisdictions.

The guidelines do not relieve the property owner, project sponsor, nor the builder of responsibility for complying with local ordinances, codes, and other building regulations that may also be applicable. This is because HUD's minimum design standards are intended to cover design and occupancy considerations of neglected and run-down properties and focus primarily on mortgage insurance considerations (e.g., increased marketability). They are not fully intended to serve in the context of a building code (i.e., primarily health and safety aspects). The structure and format of the guidelines is such that the "minimum" requirements are stated mostly in performance terms, with supplementary guides to good practice contained in accompanying, but separate, sections.

1.3.2 Rehabilitation Guidelines Developed by Model Code Organizations

In another endeavor, BOCA developed a set of rehabilitation provisions and published them under the title "Code Enforcement Guidelines for Residential Rehabilitation" (First Edition, 1975) [11]. The studies that formed the basis for these guidelines were conducted under a contract with HUD. Although published by BOCA, the other three model code organizations cooperated in their development.

These "code enforcement guidelines" have not been widely adopted by State and local governmental jurisdictions. The guidelines are intended for only residential buildings and specifically exclude hotels, motels, and other housing for transients. Even though the stated purpose of the guidelines is for the physical rehabilitation of older residential buildings with respect to safety and habitability considerations, many of the significant provisions contained in the guidelines consistently refer to the building code for new construction for the specific requirements. Even though the guidelines address some of the needs of existing neglected, run-down or unsafe buildings that are basically structurally sound, strict enforcement of the provisions would work an undue economic hardship on many owners, developers and builders.

1.3.3 Department of the Interior "Standards for Rehabilitation"

The Department of the Interior has issued a publication entitled "The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings" [12] as a means of determining if a rehabilitation project qualifies as a "certified rehabilitation" pursuant to the Tax Reform Act of 1976. The publication contains guidelines which are designed to help individual property owners formulate plans for the rehabilitation, preservation, and continued use of old buildings. The guidelines pertain to buildings of all occupancy and construction types, sizes, and materials. The format of the guidelines is such that those techniques, treatments, and methods that are consistent with the Department's rehabilitation criteria are listed in

a "recommended" column, with an adjacent column containing a list of "not recommended" items that may adversely affect a building's architectural and historic qualities.

2. Review of Some Recent Studies Relative to the Impact of Building Regulations on Rehabilitation

This section of the report contains a summary of relevant studies which discuss the impact of building regulations on rehabilitation.

2.1 "Information Structure of Building Codes and Standards for Needs of Existing Buildings," by Baird Smith

"Preservation, Rehabilitation and the Building Regulatory Process" was the theme of one of the sessions at the first major national Conference on Research and Innovation in the Building Regulatory Process³. Baird Smith, a preservation consultant, presented a paper [13] at this Conference which reported on the results of a National Bureau of Standards contract investigation on the structure and format of building standards for existing buildings.

This investigation attempted to identify and analyze the problems which existing buildings face in code compliance. It reported that code compliance causes, from the viewpoint of preservationists, the needless destruction of architecturally and aesthetically important building features, the unnecessary replacement of serviceable building materials and systems, and apparently increases the cost of preservation and rehabilitation projects.

According to Smith, the effect of code compliance on existing buildings seems to stem from the following eight characteristics of the model building codes:

1. The performance levels which a building must meet have risen throughout this century.
2. New performance attributes have been added for which there are new building code requirements.

³The First NBS/NCSBCS Joint Conference on Research and Innovation in the Building Regulatory Process was held in Providence, Rhode Island, on September 21-22, 1976, in conjunction with the Ninth Annual Meeting of the National Conference of States on Building Codes and Standards, Inc. (NCSBCS).

3. As new performance attributes were added to the model codes, problems resulted.
4. The decision process of the model codes is applicable only to new construction and does not lend itself to projects in existing buildings.
5. The various prescriptive standards of the codes are based on modern materials and do not include information about older materials.
6. The various prescriptive standards are based on what might be called standard modern building configurations.
7. Reference standards make it difficult to determine exactly what is required.
8. Information which is included about older materials, specifically fire endurance ratings, may not be an accurate indication of the performance of the material.

With these problem areas and cause-effect relationships in mind, the paper presented a concept, structure, and decision process for a possible new code or standard for use with existing buildings.

The decision process of the suggested new code judges the building for its performance in eight performance attributes, not according to the rigid prescriptive requirements of the existing model codes. The process was conceived to relate directly to the conditions present with existing buildings, conditions which differ markedly from those present in new construction.

The suggested approach calls for a fully accurate evaluation of all existing materials and systems through numerous standard on-site test methods and through the inclusion of extensive information about the physical properties of and performance data for old materials. This evaluation would hopefully eliminate the needless replacement of serviceable materials and, at the same time, provide an accurate picture of the actual performance capabilities of existing buildings.

This evaluation procedure identifies a spin-off value of the suggested new code. Just as the model codes aid designers in the design of new buildings by fixing building size, configuration and structural systems, the new code would provide a method for the designer to accurately assess the condition of an existing building and determine the amount of remedial work necessary to bring the building up to the required performance levels.

Finally, the new code called for by Mr. Smith in his paper would include sound, recognized methods for identifying and improving deficient attribute performance. This improvement would be achieved through remedial work, or the addition of technical trade-offs and operational controls. These trade-offs would increase attribute performance which would allow certain physical entities within the attribute to be retained; for instance, an architecturally important open wooden stair.

The entire decision process and concept presented in Mr. Smith's paper is illustrated in Figure 2 of this report. The process includes four stages. In the first stage, the designer chooses the occupancy classification and varies the performance attributes and the physical parameters of each. In the second stage, each of the physical parameters are identified, measured, and evaluated with the results carried into the third stage. There the performance levels of the eight performance attributes are determined by tabulating the values of the individual parameters. In the fourth stage, through remedial work, or the addition of technical trade-offs or operational controls, deficient attribute performance can be improved. The intended results are for all performance attributes to meet the required levels of performance.

2.2 "Building Codes: Preservation and Rehabilitation," by Robert J. Kapsch

In another paper [14] presented at the research conference, Robert Kapsch, of the National Bureau of Standards' Center for Building Technology, summarized the considerable growth of interest in existing buildings and the difficulties such projects pose for the building regulatory system. The paper undertook to clarify the definitional problems with such related, but significantly different, terms as "preservation," "restoration," "rehabilitation," and "recycling/adaptive reuse" with respect to the actions and uses they each imply for existing buildings.

In reporting the building regulatory response to the growing trend toward the reuse, rehabilitation, and preservation of existing buildings, the paper traces the identified need for a building standard specifically for existing building projects starting with the recommendations made by the Douglas Commission back in 1968 [15]. That Commission recommended that model standards be developed for incorporation into local building codes with special reference to rehabilitation. The Commission reported:

"There is widespread recognition among code experts that current code standards, which are intended for new construction, should not be applied literally to the alteration of existing buildings."

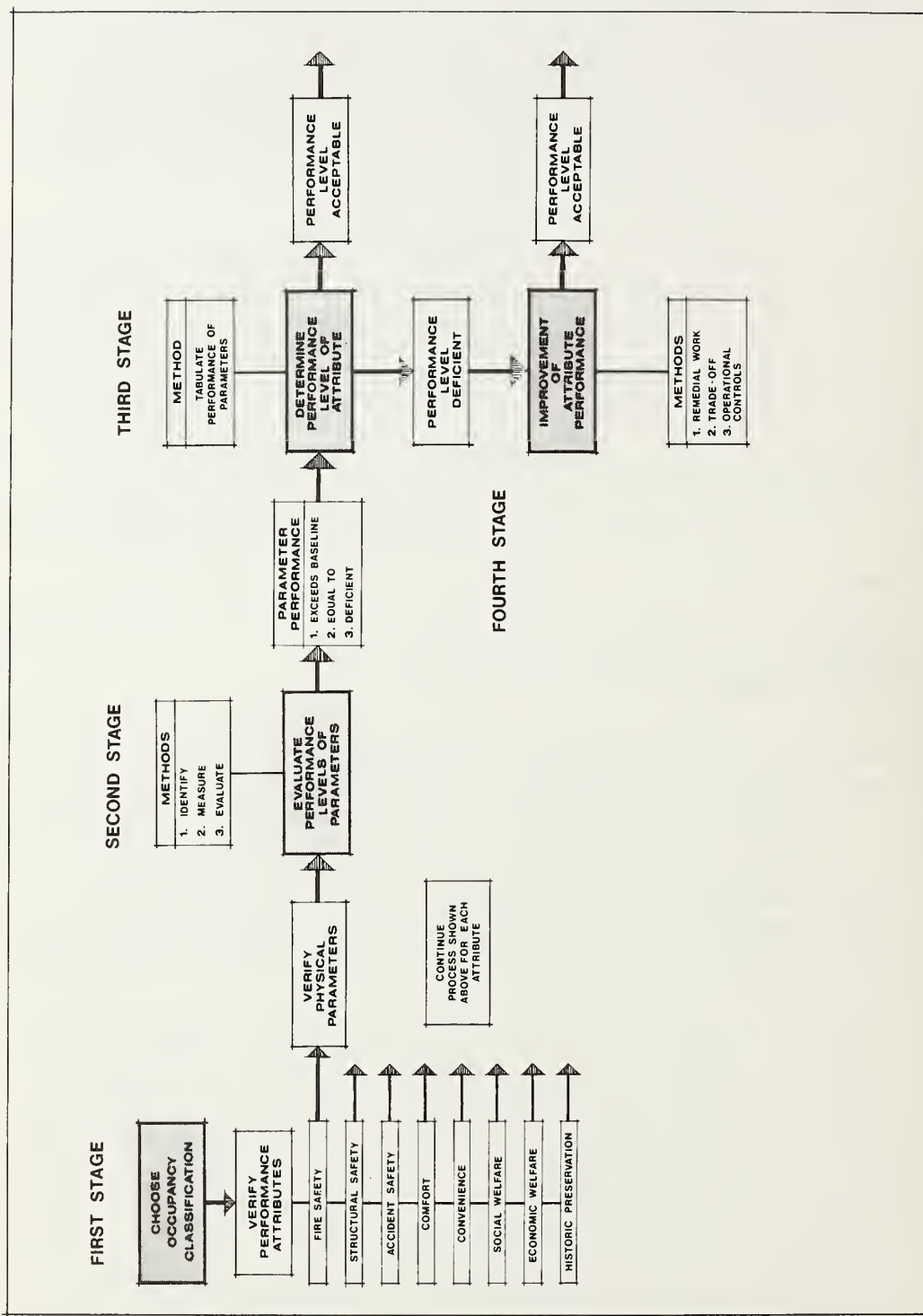


Figure 2 - Decision Process in the New Code for Existing Building

The paper goes on to find that, although this recommendation was made in 1968, little work has been done in this area, largely due to a lack of applicable building research and technical information. Among the more recent developments addressed in this paper has been the addition of historic preservation waiver clauses to the model building codes. However, the existence of such waiver provisions may not be a feasible approach for the resolution of the complex problems presented.

The Kapsch paper makes other observations and conclusions:

- o No final or definitive answer has yet been developed for the problem of achieving contemporary levels of safety and health in existing buildings.
- o The general upgrading of building codes in the United States continues today and includes the adoption of new code provisions and standards for areas such as fire safety, structural safety, physical safety and security, energy conservation, and others. Although these new and generally higher levels of building regulation provide more safety and health for the building user, they also provide a larger impact on preservation, restoration, rehabilitation and adaptive reuse projects.
- o Modern building regulations are primarily written for new construction projects. These regulations contain prescriptive and performance statements. Prescriptive statements specify the allowable materials, combinations of materials, components, assemblies, or configurations and dimensions that can be included in the construction of that new building. These prescriptive statements thus prescribe building solutions and are relatively easy to meet in new construction projects since none of the building is yet existing. Yet for preservation and rehabilitation projects, the building is existing and thus not amenable to the application of prescriptive statements--although it may have to be minimally or substantially modified to meet building code requirements. These same prescriptive statements, when thoughtlessly applied to existing buildings, can needlessly add additional project costs and destroy many of the essential architectural features of the buildings. For example, the building code prohibition, [16] "(on) the use of winders or circular stairways... in stairways serving as required exits," and the related building code requirement, "The minimum width of any stair serving as a means of egress shall not be less than forty-four (44) inches, except that stairs serving an occupancy load for less than fifty (50) people may be thirty-six (36) inches in width," may have a tremendous impact on the large number of old buildings that use circular stairways primarily or exclusively. In fact, what usually has to be done in such buildings is to construct a new

structure adjacent to the existing building to house a new stairway or to create a space within the existing building for the required stairway.

2.3 "Survey of Building Code Provisions for Historic Structures," by Melvyn Green and Patrick Cooke

In order to better understand the conflicts between health and safety objectives and historic preservation objectives, the National Bureau of Standards sponsored a study in 1976 to determine what actions regulatory bodies were taking with respect to preservation projects [17].

Responses for this study were solicited from:

- o Delegates to the National Conference of States on Building Codes and Standards, Inc. (NCSBCS)
- o State Historic Preservation Officers
- o Regulatory officials of the member cities of the Association of Major City Building Officials (AMCBO)
- o Model Building Codes (Basic Building Code, Standard Building Code, Uniform Building Code)
- o Other interested jurisdictions and organizations

This study revealed a growing adoption and use of:

- o Historic preservation waiver clauses in building codes
- o Administrative regulations included in historic district legislation and similar regulations containing similar provisions as the building code waiver clauses

Of the 47 State responses, 11 reported special code provisions in effect, and five reported special administrative regulations. This is particularly significant as 23 States now have mandatory or voluntary statewide building codes [1].

Of the 16 States reporting special code provisions or administrative regulations for preservation, nine reported special boards to regulate preservation. On many of these boards, the State Historic Preservation Officer was represented. It is also significant to note that the first such provision was adopted in 1971 by the State of Alaska.

The survey indicated that, of the 24 Association of Major City Building Officials city responses, seven reported special code provisions in effect and eight reported special administrative regulations.

Perhaps most significantly, the survey also indicated that two of the model building codes had adopted historic preservation building code provisions, the Uniform Building Code and the Basic Building Code and the third, the Standard Building Code, had a similar provision under consideration. A fourth model building code, the National Building Code, just recently added special provisions for existing buildings. These model code survey results are significant as these model codes serve as the technical basis for many, if not most, of the building codes used in the United States. New provisions in the model building codes are usually adopted by State and local jurisdictions.

The results of this study revealed the need for additional research to resolve various technical problems and conflicts between preservation objectives and building codes. Among the areas considered appropriate for further research were:

Implication of Legal Liability for Designers/Regulators:

- o In the case of the codes, it is necessary to evaluate the significance of individual code provisions since provisions for life safety, structural safety, sanitation, electrical standards, fire districts, and many others exist side-by-side without reference to individual necessity or importance. Some of these provisions are absolutely essential to the safe operation of a building, others represent desirable levels of amenity which would not endanger public health or safety if abrogated in special cases. Where code provisions are abrogated, serious questions concerning the designer's liability may arise. Further study of this problem is necessary.

Historic Preservation Clauses:

- o The effectiveness of existing historic preservation clauses and codes should be evaluated in terms of their ability to facilitate historic preservation and to provide an acceptable degree of safety to the building's users.

Risk Analysis: Further research is needed to enable designers and building officials to establish an accurate evaluation of risk for a particular building.

Technical Trade-offs: This system is used in New York State, where the building official is allowed to make determinations of acceptable alternate fire safety measures for restored

buildings. Design alternatives for use in technical trade-offs and code compliance should be developed.

A Historic Preservation and Building Code Solution Catalog:

- o This would provide a vehicle for communicating goal-oriented solutions to designers and building officials.

Alternate Provisions for Handicapped Access to Historic Buildings:

- o The only State reporting specific consideration of access for the handicapped was North Carolina, where the code provides exemption for historic buildings. However, further research may be done on providing access without disruption of the historical integrity of the building.

Operational Control for Historic Building Use:

- o This method was being used in Indiana, where the Building Official may grant exemptions from building code provisions for historic buildings, provided signs are posted to warn users that the building does not meet normal safety standards. A limitation may also be placed on number of occupants.

Occupancy Modification:

- o A historic building might be subjected to control of occupancy to reduce fire hazard; or a special occupancy class for historic structures might be developed to permit greater flexibility in administering building code provisions.

2.4 "Urban Housing Rehabilitation in the United States," by Nathaniel Rogg

In 1977, the United States League of Savings Association [18] commissioned Nathaniel H. Rogg, the retired Executive Vice President of the National Association of Home Builders, to examine activities connected with urban rehabilitation and to draft a program aimed at expanding the housing rehabilitation industry. The U.S. Leagues' interests in such a program would presumably include the promotion of increased or new lending opportunities in city neighborhoods. To find out what is actually happening and what the problems are with urban rehabilitation, Rogg visited a number of U.S. cities during the spring and summer of 1977. The cities visited were Baltimore, Boston, Chicago, Cincinnati, Cleveland, Dallas, Houston, Oakland, Pittsburgh, St. Louis, and Washington, D.C. The focus was primarily on single-family housing. In his report to the U.S. League, [19] Mr. Rogg identified building codes as one of the serious public constraints which adversely affects the volume of rehabilitation activity [20].

An accompanying and related constraint in the public sector was finding that many local governments are not properly equipped to promote rehabilitation. The report states:

"They lack public policy or the appropriate organization, or both. In almost all cases, the process of regulatory standards, clearances, licenses, permits, and so on discourages both the entrepreneur and the homeowner." [21]

The report cites instances of builders complaining about the time consuming difficulty of doing business with big city building departments and, in some cases, about extra taxes and the multiplicity of permits required.

The report makes general recommendations relevant to the constraints Mr. Rogg observed which are caused by building codes and the regulatory process.

- o The housing industry should work with cities to develop rehabilitation codes which are less rigorous than codes for new structures.
- o The private construction industry should work closely with local government officials in developing local housing policies and programs implementing those policies. Private sector groups must participate in supplying a practical aspect to such matters as local housing assistance plans, the use of community development block grant funds, codes and zoning, and local capital improvements. This is imperative if local revitalization efforts are to have maximum results. The local construction industry, in all of its aspects, must become informed in and a contributor to the development of the appropriate policies in its own locality.

Among the specific recommendations directed at local governments were:

- o Make sensitive and flexible housing code enforcement a vital part of neighborhood rehabilitation.

A code enforcement program by itself is not enough. It must be tied in both with a solid basis for determining what needs to be done to improve the house and with advice and counseling for residents to help them find financing and contractor services. A multi-tiered enforcement strategy should be explored with due concern for the differences between owner-occupied and rental housing. Such a code enforcement strategy should be aimed at the goals of aiding families in the neighborhood to achieve adequate housing as well as protecting the neighborhood and its housing supply from deterioration. In connection with code enforcement, there is need for a detailed work write-up or

specification sheet, on which a contractor can bid and on which a lender can lend. Good examples are the worksheets developed in Boston and by the Neighborhood Housing Services (NHS) for use in many areas, notably Pittsburgh.

- o Develop rehabilitation codes on a less stringent basis than codes for new construction.

Rehabilitation codes should not result in discrimination against older housing built in a different day and to different standards.

There was an effort in the 1960's to develop such a code at the Federal Housing Administration. This effort should be reviewed with an eye to giving cities a model rehabilitation code.

- o Examine the possibility of making zoning changes to strengthen neighborhoods by encouraging homeownership.

For example, zoning could be changed from multifamily to single-family.

- o Streamline building permit and inspection service procedures.

The process of obtaining permits and inspections should not in itself discourage rehabilitation. Because of excessive paperwork and delays, some builder-developers now generally find it easier to work in the suburbs with smaller bureaucracies.

2.5 "New Approaches to Urban Housing," by United States League of Savings Associations"

In another report, prepared by the Urban Affairs Executive Committee of the United States League of Savings Association, [22] the mitigating aspects of local building codes and the process of enforcement with respect to rehabilitation efforts are further discussed. The report finds that:

". . . Much housing policy is formulated at the local government level. Zoning ordinances, housing, and building codes, and tax assessments are functions through which local governments exercise substantial control over land use within their boundaries. Building and housing codes must be brought up to date and reformulated in terms of the performance criteria necessary to allow for new construction materials and processes. Rehabilitation codes are needed that avoid requirements which may be suitable for new construction, but are unnecessary and costly for rehabilitation. Administration of codes and inspections must be improved to avoid unnecessary obstacles to rehabilitation that drive up costs."

In a series of general recommendations concerning the development of a "housing rehabilitation industry," the report advises:

"... The government could make another major contribution by promoting nationwide housing and building code enforcement and flexibility. The problem at one extreme is lax code enforcement that contributes to decay and at the other extreme the existence of codes so stringent, inflexible and ill adapted to rehabilitation that they make rehabilitation difficult or the cost prohibitive."

Rehabilitation codes should be developed which will maintain adequate health and safety standards for older buildings, without imposing unrealistic and costly new construction requirements.

2.6 "An Investigation of Regulatory Barriers to the Re-Use of Existing Buildings," by Massachusetts Institute of Technology

During 1977, the NBS Center for Building Technology provided a research grant to the Massachusetts Institute of Technology (MIT) for a team study to examine the nature and scope of applying building codes to existing buildings. The research objective of the MIT team⁴ was to further define the various problems involved with the building regulatory system and to develop a strategy for measuring the impact of these problem areas. The investigation was based on selected Massachusetts case studies to illustrate problems and solutions in building code applications.

Based on their investigation, the team concludes that existing buildings pose a significant problem for code interpretation and enforcement [23]. Problems develop primarily from prescriptive code requirements where technical provisions require identical compliance from both new construction and existing buildings. While in general, code problems are manifest technically, the recommended solutions extend beyond technical change to political, social, educational, and administrative change.

The research agenda, based on team perceptions and collected data, suggests that further investigations in a variety of areas will be necessary before a code can be developed which responds clearly to existing buildings.

⁴The MIT Consortia includes, in addition to researchers from MIT Department of Architecture, the professional architecture office of Perry, Dean, Stahl and Rogers, Inc., Architects and Planners, along with experienced building officials and code administrators from selected municipal building departments in Massachusetts.

The team identified six agenda areas: historical, behavioral, technical, educational, administrative, and social. In its report, the team recommended that inquiry in all of these areas is necessary for long-range solution of code-rehab problems and that all six areas bear on the establishment and administration of a firm technical base.

The specific recommendations for the six areas as presented in the preliminary report are:

1. Historical Issues

Intent: To identify and evaluate the operative technical bases of all sections of the codes.

Investigation: Based on the team's perceptions that codes are not up-to-date or based on current research, the team recommends investigation of the origins of code provisions. Comparison between these origins and current research should reveal technical discrepancies in the code.

2. Behaviorial Issues

Intent: To establish the importance of behavioral information to the technical base by examining how research on behavior can be related to code standards.

Investigation: The team recognized the need to examine behavioral research in order to establish a sound technical base for code provisions. Compiled research might include information on mobility in different environments, windowless environments, motivations and fear as factors in building evacuation. Such a research effort would involve behavioral scientists examining the codes for their implications to current research.

3. Technical Issues

Intent: To develop sound technical models for relative safety and health, and position existing buildings within these models.

Investigation: The team recognized that existing systems and new systems must be measured against standards of safety and health. The team recommends the investigation of safety levels for existing buildings based on use type, construction type, occupancy levels, and configuration. The team recommends that research on safety or hazard levels include some testing of building types, and much modeling based on test results. An administrative model for trade-offs and compliance over time and an incentive model for owner compliance would aid in code enforcement.

4. Educational Issues

Intent: To provide a more capable corps of code inspection officials.

Investigation: The team recommends that minimum educational requirements and qualifications for code officials be investigated based on the work scope suggested by the code-rehab issues.

A training program, based on issues, risks, technical systems and evaluation of existing buildings, should be developed.

5. Administrative Issues

Intent: To simplify the code administration bureaucracy.

Investigation: The team recommends an examination of code bureaucracies with the intent to simplify administrative processes.

6. Social Issues

Intent: (a) To determine the social vs. economic cost/benefit of codes.

(b) To identify values implicit in current code provisions.

Investigation: (a) The team recommends examination of the informal sector to weigh the effects of code compliance on availability of housing and relative safety of housing.

(b) An examination of the social implications of code provisions would reveal the underlying social bases of the code. By determining the social values implicit in a code one can establish how the code reflects current life-styles and value systems, and the extent of the role regulatory processes play in establishing types of social environments.

2.7 "Assessment of Current Building Regulatory Methods as Applied to the Needs of Historic Preservation Projects," by National Trust for Historic Preservation

The NBS CBT also sponsored a project, in conjunction with the National Trust for Historic Preservation, to detail specific regulatory problems encountered by those engaged in preservation of historic structures as well as general rehabilitation of buildings. The project was based on assessing the experience from several case studies and

focused primarily on those issues dealing with the needs for technology and standards development. Specifically, the objectives of the study were to:

- o Identify, evaluate and propose historic preservation categorical definitions as applied to buildings
- o Develop performance objectives, requirements, criteria and tests for each definition category
- o Identify and assess those current methods most commonly used by regulatory jurisdictions to mitigate adverse impacts on building preservation projects

In its report [24] on the project, the National Trust identified the following as the four most common building regulatory problems which adversely impact preservation projects.

- o The accommodation of a change in the principal use and the accommodation of mixed use
- o Having existing stairways and exits meet requirements, including access for the handicapped, and/or integrating new ones which do not violate the aesthetic/historic character of the building
- o Providing fire egress routes while maintaining the character of the existing materials
- o Changing existing and/or adding new electrical, mechanical, ventilation and fire detection/protection systems which do not violate the aesthetic/historic character of the building

The report also indicated that the most commonly dealt with historic building types were residential, commercial and institutional, in that order of frequency.

The building uses which presented the most commonly encountered problems were public assembly, commercial and residential, in that order.

With regard to those methods that have been used successfully to mitigate adverse building regulatory requirements on historic building preservation projects, the study identified:

- o Face-to-face negotiation process with local building regulatory representatives throughout the building preservation process to meet the code requirements and to minimize adverse impact on building

- o Specific historic building provisions in the code which permit the granting of variations from the code for historic buildings
- o The existence of a special appeal board process for requirements as applied to historic buildings
- o The proposal of code revision provisions to alleviate the most objectionable of the existing requirements

3. Study of Regulatory Needs for Building Rehabilitation

3.1 Questions Addressed

A study was outlined by the Center for Building Technology to determine the needs of model building code organizations, and selected State and major city building regulatory agencies, in regard to rehabilitation of existing buildings. The National Conference of States on Building Codes and Standards, Inc. (NCSBCS)⁵ collected the data under contract to CBT.

The major questions addressed by the study were:

1. Is a regulatory document for rehabilitation of existing buildings needed?
2. If so, what should be the intent and coverage of such a document and what should be the form (code provisions, standards, guidelines, etc.) in regard to the following:
 - a. Occupancies and building types to be covered
 - b. Building systems to be included (e.g., structural, plumbing, electrical, mechanical, etc.)
 - c. Revision or elimination of the "25-50 percent" rule
 - d. Preferred format and method of expression (performance, prescriptive, or some combination)
 - e. Philosophy and methodology for the selection of requirements and compliance levels
 - f. Guidelines for determining and applying alternate solutions to prescriptive code requirements

⁵NCSBCS serves a broad national membership of State-appointed delegates, representatives of the model code groups, State and local building regulatory groups, national standards making organizations, industry, consumers and other individuals affected in the development and enforcement of construction codes and standards.

3. What are the technical needs in regard to building rehabilitation?
4. How does the current regulatory process, with respect to code administration and enforcement, affect rehabilitation?

3.2 Model Building Code Study

The three organizations included in this study were the Building Officials and Code Administrators International, Inc., Southern Building Code Congress International, Inc., and International Conference of Building Officials.

The following summary conclusions resulted:

1. The provisions of current codes do not reflect the possible constructions and configurations which occur in existing buildings. Model code provisions are needed for building rehabilitation written in such a manner that no solution consistent with acceptable public protection is eliminated from consideration. They should apply to most building types and provide a systems approach that considers the building in its entirety with respect to each of the health, safety and welfare attributes regulated. The format developed should be complementary to existing model codes, and provide a structured technical basis for decisions in place of current ad hoc judgment techniques. The specific format developed should pattern the rehabilitation process (i.e., analysis), rather than current codes which model the design process for new buildings (i.e., synthesis). These model provisions should be sufficient to serve either as an element or chapter of an existing building code, or as a separate standard to be adopted by reference.
2. Research will be necessary to provide the technical basis for rehabilitation decision making. An aspect of this research may be historical, documenting past performance of particular materials, assemblies, constructions, etc. In order to avoid repetitive generation of similar data, technical solutions, once developed, should be incorporated into manuals of practice which illustrate specific solutions to common problems. The function of these manuals would be to maximize accessibility to technical information for the designer, building official and others involved in rehabilitation.
3. A model process for administering rehabilitation projects by local regulatory agencies should be developed to properly provide for the unique aspects associated with the analysis and design of

such buildings. Consideration should be given to the numerous ad hoc methods currently in use by local enforcement agencies in the development of this process.

3.3 State and Major City Study

Another aspect of the NCSBCS project was a study of State and major city regulatory agencies as well as interviews with knowledgeable non-regulatory personnel (developers, builders, etc.) involved in building rehabilitation. The representative States included were Florida, Massachusetts, Minnesota, New Mexico, North Carolina, Ohio, Oregon and Wisconsin. The cities were Atlanta, Baltimore, Chicago, Cincinnati, New Orleans, and Seattle. Highlights of the study results follow:

1. Need for a Regulatory Document - The perceived need for such a document was not unanimous, and some negative reactions were voiced. The need for a rehabilitation standard or code provisions was questioned by many building regulatory officials. There was agreement that guidelines or some other documentation is needed which would be legally defensible to guide building officials in the use of judgment with regard to health and safety performance of alternative solutions. It was acknowledged that any such document may be helpful with certain qualifications:
 - a. It should not add still more prescriptive requirements
 - b. It should increase the flexibility of the building officials by assisting in making interpretations
 - c. It should promote the concept of "equivalent protection" by allowing alternate solutions for prescriptive requirements and provide specific examples
 - d. It should provide the technical basis for decision making
2. Technical Issues - Even though a rigorous analysis of technical issues having the most impact on rehabilitation was not attempted, some technical issues were identified during the study. On major rehabilitation, "fire protection" problems were most prevalent. Egress issues included the number, location and dimensions of exits, with the specific problem of open stairways. Other problems identified included fire rating requirements of materials used for walls, floors, ceilings; fire district locational factors, particularly for adaptive reuse of large structures; area and height requirements, particularly for heavy timber construction; and mechanical and electrical provisions for venting, air changes, new electrical wiring, service and outlet requirements.

3. Philosophy of Regulatory Document - The majority of building regulatory agency respondents who are involved with both existing buildings and new construction stated they had difficulty accepting a concept with dual levels of compliance. On the other hand, personnel of agencies only involved with rehabilitation of existing buildings had little difficulty in accepting dual levels within reasonable limitations.

However, it was quite apparent, from discussions, that many of those opposed to dual levels were allowing variances from new construction requirements for building rehabilitation. The terms "judgment," "trade-off," "equivalent," "experience," "as close as possible," and "deemed to satisfy" were often used. Most respondents were not able to describe a reasonable analytical procedure or technical basis upon which to base their reported judgmental decisions on variances. This indicated that a rational framework is required if uniform, consistent interpretations of safety, health and general welfare principles are to be achieved in building rehabilitation efforts. The philosophy of "equivalent protection" was quite acceptable to all respondents, with the decision of alternate solutions based upon the technical judgment of competent, experienced personnel or appeals boards.

The term "performance" approach concerned many respondents since they felt they did not have the ability or experience to make the required decisions. The ability to adequately define code provisions in performance terms, which would result in buildings being as safe as current prescriptive approaches, was also questioned. Other concerns were the lack of technical data required to make decisions relative to performance and the ability to enforce such provisions given the current building regulatory system.

4. Legal Implications - One major issue which surfaced was the apparent removal or lessening of the legal shield for building officials and inspectors when codes are not enforced to the letter of prescriptive requirements. It was reported that over the past few years several court decisions have assessed damages against individual building officials in cases where "judgment" had been used in code enforcement, and later injury or loss of life resulted in a rehabilitated structure. A rehabilitation document which provides rational technical justification for "judgmental" decisions would be welcomed.
5. Procedures and Processes In Building Code Administration - The study indicated that certain procedural elements in building code administration contributed to successful building rehabilitation programs in various jurisdictions.

It is the policy of the Baltimore Building Department to have extensive discussions with developers, architects, engineers and/or owners concerning rehabilitation projects--often before a developer will purchase property considered for rehabilitation. In these discussions, all aspects of the proposed project are discussed and evaluated, including technical and economic issues. The results are a pre-permit agreement which defines the design solutions which will be acceptable to the Building Department. Other governmental agencies are often involved in this agreement. For example, when a situation exists with regard to fire protection where strict compliance with the building code for new construction is not a viable solution, appropriate fire department personnel participate in the agreement on alternate solutions.

The Cincinnati Field Inspection Division reviews plans of all rehabilitation projects in addition to the Zoning and Plan Review Sections. The Division also conducts a pre-permit inspection for code conformity and existing defects. This technique has reportedly assisted in reducing field inspection problems when the work begins. A similar technique of pre-permit discussions is required in Seattle, but only for high-rise rehabilitation. It is called a design conference and involves the developer, building and fire departments.

Wisconsin utilizes a procedure called "Petition for Modification" in which any design, either for new construction or for rehabilitation, is completely laid out, alternate solutions considered and rationalized, and decisions completely documented. In this manner, a series of precedents are established which tend to govern the kinds of alternate solutions which would be accepted under the code.

The appeals procedure in Chicago is from the inspector to the Building Commissioner, then directly to the courts--there is no formal appeals board. Several respondents felt strongly that an appeals board outside of the building department would ease code problems in their city (both for new and existing buildings).

6. Application of "25-50 Percent" Rule - Most jurisdictions have some version of this rule in effect. However, it is interesting to note that California has legislatively abolished the rule and Baltimore has never used the rule. It was pointed out by respondents that, in some jurisdictions where the rule exists, it is ignored or not enforced. Others, however, indicate that the rule is enforced to the degree that it adversely affects rehabilitation efforts.

Many respondents expressed dissatisfaction with the determination of the cost basis for application of the rule. Some suggested approaches were:

- a. Exclude cost of meeting subsystem requirements (e.g., electrical, plumbing, mechanical)
 - b. Use base assessed valuation after, rather than before, rehabilitation
 - c. Include only costs of meeting minimum requirements and not amenities in excess of minimum
 - d. Use another parameter instead of dollar value, e.g., a physical parameter such as area of the building
 - e. Base actions on a hazard analysis with no arbitrary parameters, either dollar or physical
7. Occupancies and Building Types to be Covered - Respondents generally stated that all occupancies and building types should be covered by any new regulatory document for building rehabilitation. It was quite apparent in discussions, however, that residential and commercial rehabilitation were most prominent in their thinking. The building regulatory personnel appeared to feel that they had few problems in the 1-4 family residential building, but had much greater problems in the larger structure--both residential and commercial. The reporting of few problems in the 1-4 family category appeared to be based on: (1) a perception that this is one of the least hazardous occupancies, and (2) code enforcement was generally to minimum requirements of the housing code, with the implication that codes for new construction contain greater than minimum requirements by including many amenities.
8. Building Subsystems to be Included - There was general agreement that all building subsystems (structural, plumbing, electrical, mechanical, etc.) should be considered in any new document. It was recognized that work on these subsystems in existing buildings could involve up to 50 percent or more of the cost of rehabilitation; hence, should be included. Also, the degree of risk to public health, safety and welfare, and other imminent dangers resulting from subsystems problems must be considered in any overall rehabilitation document.
9. Philosophy and Methodology for Selecting Compliance Levels - Many respondents had difficulty with this issue since it was interpreted as allowing differing levels of performance--not only between existing and new buildings--but perhaps also between existing buildings for reasons other than health and safety. Some comments on this issue included:

- a. Distinguish between soundly based minimum safety requirements and requirements representing more modern materials and technologies that may be considered amenities
- b. Perhaps accept any system of an existing building which does not conform to the current code for new construction as long as it conforms with the codes in effect at the time of its construction
- c. A maintenance code for commercial and other occupancies similar to a housing code may be needed

3.4 Synthesis of Study Results

Two meetings were held at NBS in December 1977, and February 1978, involving representatives from CBT, NCSBCS and the model building code organizations (BOCA, ICBO, SBCC).

These were working meetings structured to define programmatic and technical needs for regulation of building rehabilitation. Various NBS activities relative to rehabilitation were reviewed including development of technical criteria, retrofitting for energy conservation, economic analyses, historic preservation and restoration, and technical constraints to effective rehabilitation. Substantial discussion centered around the Fire Safety Evaluation System for Health Care Facilities developed by the NBS Center for Fire Research (CFR) and the application of this system to general rehabilitation [25]. A summary of the NCSBCS study was then presented and the significance of the results discussed as they relate to overall program development. The initial framework for discussion of the issues resulted in the development of a matrix shown in Table 1 which identifies: (a) regulatory problems impacting on each participant, (b) technical input needed to alleviate the problem, and (c) the participant in the rehabilitation process (e.g., owner, developer, code official, etc.).

This analytical process, utilizing a diverse group, resulted in defining nine major participants, thirteen building rehabilitation regulatory problems, and eight technical inputs required to alleviate the problems. The eight technical inputs required are:

1. Validation of technical constraints in current codes for various occupancies
2. Technical basis for elimination or modification of the "25-50 percent" rule
3. Performance requirements for existing buildings
4. Catalog of building systems no longer in use

Table 1 - Regulatory Rehabilitation Problems and the Relationship to Participants in the Process and Their Technical Needs

Regulatory Problem	Technical Input Needed to Alleviate Problem	Participant
1. Limitation on options for occupancies	A	Owner/Developer
2. Application of 25-50% rule	B	Owner/Developer, Code Official
3. Difficult to establish requirements from prescriptive solutions	C	Owner/Developer, Architect/Engineer, Code Official, Materials Supplier
4. Evaluation of existing condition in building (in relation to code)	D, E	Architect/Engineer, Code Official, Builder, Finance/Insurance
5. Impediment to innovation	C, F	Architect/Engineer, Materials Supplier
6. Lack of intent guidelines in existing codes	C, D, E, G	Architect/Engineer, Code Official, Materials Supplier
7. More judgment required, therefore, more liability (and complications)	A, H	Architect/Engineer, Code Official
8. Inability to relate performance of pre-modern designs to modern regulations	C, D, E	Architect/Engineer, Code Official
9. Ad hoc regulatory process	F	Architect/Engineer, Code Official, Builder
10. Inadequate bases for technical decisions	C, D, E, G, H	Architect/Engineer, Code Official
11. Variable levels of safety between new and existing buildings	C, H	User
12. Obstruction of community preservation	C, F	Community
13. Coordination and conflict	C, F, H	Builder, Materials Supplier, Finance/Insurance, Government Agencies

Key for Technical Inputs:

- A - Establish validity of technical constraints
- B - Technical bases for elimination of the 25-50% rule
- C - Performance requirements for materials, components and systems
- D - Catalog of building systems no longer in use
- E - Nondestructive evaluative methods
- F - Improved regulatory process
- G - Definitive code intent statements (guidelines, levels of safety, durability)
- H - Legally defensible requirements and/or process

5. Destructive and nondestructive in-situ evaluation methods
6. Improved regulatory process for existing buildings
7. A definitive code statement which explicitly spells out the intent of the code in regard to building performance
8. Legally defensible code requirements and enforcement process

Further discussion resulted in a consensus on four issues relative to the development of a regulatory document for building rehabilitation:

1. A document is needed which will encompass all occupancy building types, including mixed and multiple occupancies. The problems encountered in residential, business, mercantile, mixed and multiple occupancies should be given priority.
2. A system approach should be utilized covering the building as a whole, including all subsystems (e.g., structural, plumbing, electrical, mechanical, etc.).
3. The "25-50 percent" rule does not appear to be a workable solution in regard to the application of regulations for new construction to existing structures. The conceptual approach to be explored is illustrated in Figure 3 and is based upon the concept to allow repairs, alterations and additions to existing buildings without meeting all new construction requirements under the following general conditions:
 - a. All high hazardous conditions must be corrected
 - b. The building must be occupiable under current requirements
 - c. The existing building becomes the minimum performance requirement
 - d. The performance level of the building after rehabilitation must not be below that existing before the change
 - e. Additions would be required to meet code requirements for new construction or equivalent
 - f. Compliance with the building code for new construction or its equivalent may be required when the change in use is to a more hazardous occupancy or use group.

It is recognized that many technical judgments will be required by building officials to implement such a regulatory concept, as compared to the current situation where compliance with the code for new construction is often required. These judgments can be supported by technical data and determined by application of equivalency methods such as those developed by Nelson [25].

----- COMPLIANCE WITH BUILDING
CODE FOR NEW CONSTRUCTION

CODE CONCEPT

1. ALL HIGH HAZARD CONDITIONS MUST BE CORRECTED.
2. THE BUILDING MUST BE OCCUPIABLE.
3. THE EXISTING BUILDING BECOMES THE MINIMUM PERFORMANCE REQUIREMENT.
4. THE PERFORMANCE LEVEL OF THE BUILDING AFTER REHABILITATION MUST NOT BE BELOW THAT EXISTING BEFORE THE CHANGE.
5. ADDITIONS WOULD BE REQUIRED TO MEET CODE REQUIREMENTS FOR NEW CONSTRUCTION OR EQUIVALENT.
6. COMPLIANCE WITH THE BUILDING CODE FOR NEW CONSTRUCTION OR ITS EQUIVALENT MAY BE REQUIRED WHEN THE CHANGE IN USE IS TO A MORE HAZARDOUS OCCUPANCY OR USE GROUP.

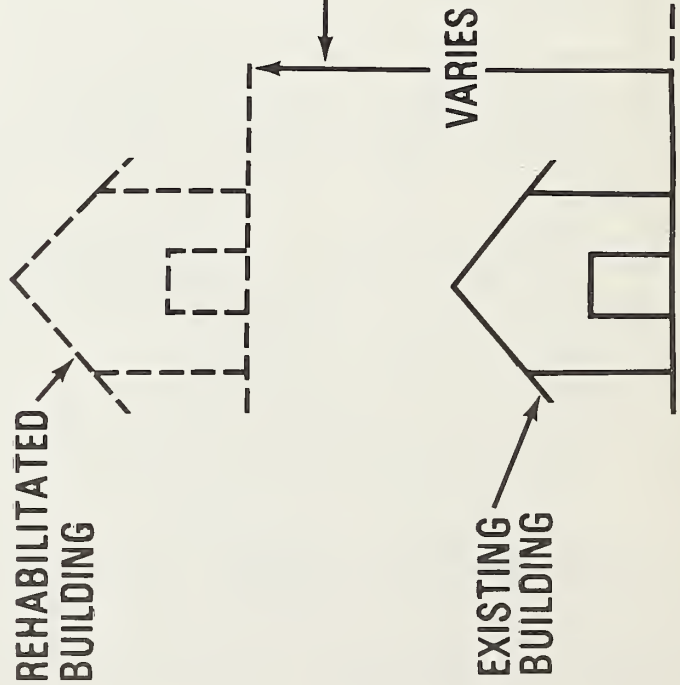


Figure 3 - New Code Concept for Repairs, Alternations, Additions
To and Changes In Use of Existing Building

4. Technical evaluation manuals should be developed to provide a basis for rehabilitation decision making.

4. Rehabilitation Technology Program

A program structured to respond to the needs identified in this report has been formulated by CBT and includes the following elements:

1. Development of the Technical Basis for Regulations and an Improved Regulatory Process
2. Development of New Technology and Evaluation Tools
3. Development of Responsive and Cost-Effective Decision Tools

This approach is designed to support on-going national activities for building rehabilitation. Sections 4.1, 4.2, and 4.3, describe each program element.

4.1 Technical Basis for Regulations and an Improved Regulatory Process

4.1.1 Introduction

The study discussed in Section 3 pointed out the need for an improved technical basis of regulations and a regulatory process which is designed to address the specific needs of rehabilitation of existing buildings. This conclusion is supported by a report by the Massachusetts Institute of Technology, [23] which recommends "investigation of the origins of code provisions and the comparison between these origins and current research should reveal technical discrepancies in the code." The same report recommends "an examination of code bureaucracies with the intent to simplify administrative processes." At hearings of the Committee on Banking, Housing and Urban Affairs, chaired by Senator Proxmire, on March 24, 1978, [26] Frederick Stahl recommended the Federal Government "emphasize research, testing and methods development" and "training of regulatory personnel for review and technical assistance, and for inspection and public relations." In the same report, Durwin Ursery states that problems with code administration for existing buildings "range from field inspection judgment, plan review staff assignments, reevaluation by field inspectors for occupancy permits and unclear and ambiguous procedures for approval of plans and issuance of building permits."

4.1.2 Massachusetts Pilot Project

On March 4, 1978, Governor Dukakis of the State of Massachusetts initiated a pilot project to develop an interim building rehabilitation

code for the State. NBS, through the Center for Building Technology, was invited to provide technical support to a team of building regulatory organizations including NCSBCS, BOCA, ICBO, SBCC, the Association of Major City Building Officials (AMCBO), the National Association of Housing and Redevelopment Officials (NAHRO), and the National Academy of Code Administration (NACA). The final draft of the interim code provisions and the supporting technical reference standards were completed in August 1978 and forwarded to the members of the Massachusetts State Building Code Commission for review and comment. These comments were received by the project team and were incorporated into the draft Article 22 of the Massachusetts State Building Code entitled "Repair, Alteration, Additions and Change in Use of Existing Buildings [27]." This article was adopted for implementation in the State in early 1979. The provisions developed incorporate the code concept presented in Section 3.4 of this report as a replacement for the "25-50 percent" rule. This Massachusetts Pilot Project was discussed at the National Conference on Regulatory Aspects of Building Rehabilitation held at NBS on October 30, 1978. The proceedings of this conference will be published in early 1979.

4.1.3 Technical Bases of Regulations

The regulatory strategy developed in the Massachusetts Pilot Project calls for the levels of performance that may be less than those for new construction as long as minimum life-safety and health levels are maintained. In order to determine these levels, it will be necessary to study the technical bases of regulations and to carry out needed research. This will provide a methodology for the development of performance criteria for existing buildings as well as guides for selection of compliance levels for various building types and occupancies. This activity was initiated in FY78 with a comparative analysis of the technical provisions of regulatory documents affecting existing buildings, including housing codes [6, 7, 8, 9] and rehabilitation guidelines [10, 11]. This analysis will assist in identifying current levels of performance for existing buildings and will provide a basis for selection of revised levels by regulatory authorities, if necessary. It will also assist in the identification of research study areas relative to the technical bases of regulations and the development of priorities.

4.1.4 Regulatory Process for Existing Buildings

The current regulatory process has been identified as impeding the full utilization of existing buildings. Difficulties result when rehabilitation projects are forced into a model established for new construction. A study has been initiated to determine specific aspects of the regulatory process relative to building rehabilitation used in the thirty largest cities in the United States, which are members of AMCBO. These data will include documentation requirements in regard to design analysis and approval, plan evaluation, permit process and field

inspection; regulatory personnel qualifications, including educational and training requirements; intragovernmental relations; legal aspects of enforcement; and appeals and waiver processes. These data will be utilized to develop a draft model enforcement process for existing buildings in FY79. Such a system would typically include: (1) model documents for submittal and compliance procedures; (2) pre-construction meetings of owner, designer and building official; (3) interaction between various government agencies; (4) mechanism for building owner/designer to appeal decisions of building officials; and (5) availability of technical resources. The model process developed should be sufficiently flexible to be used with minor modifications by the majority of building code enforcement agencies. Where possible, the proposed model enforcement process will be evaluated on a trial basis in cooperation with local and State jurisdictions which face different types of rehabilitation activity.

4.2 Development of New Technology and Evaluation Tools

4.2.1 Introduction

As pointed out previously, the building code for new construction, with its generally prescriptive format, is the existing regulatory basis for building rehabilitation. This presents difficulties since these codes: (1) may not address the types of construction present in many older buildings, (2) they are structured to follow the new construction process (design) as compared to the actual case (analysis) for existing buildings, and (3) they limit innovative solutions. Additionally, those involved with rehabilitation face a lack of information or a lack of awareness of the availability of information on technical matters required to make the best decisions in evaluating the existing structure and in selecting appropriate materials, systems, and application techniques. This conclusion is supported by Stahl, [26] who states that what is needed "is a reliable set of analytical methods by which the performance of a building and building components which already exist can be rapidly, readily and effectively assessed."

4.2.2 Technical Manuals for Rehabilitation Decision Making

As discussed in Section 3.4, the need for a series of technical manuals containing state-of-the-art listings of technical data for building components and specific health, safety and general welfare attributes, shown in Figure 4, was identified. These manuals would include: (1) test methods for destructive and nondestructive evaluation of existing construction, (2) methods of analysis to predict the performance of existing construction, (3) field inspection and evaluation methodologies, and (4) data on the performance of outdated systems. A manual is

MANUALS FOR EVALUATION

COMPONENTS	ATTRIBUTES							
	STRENGTH AND STABILITY	HEALTH AND SANITATION	ACCIDENT SAFETY	FIRE SAFETY	ENERGY CONSERVATION	SECURITY	OTHERS	
STRUCTURE								→
ENCLOSURE AND SPACE								→
MECHANICAL (HVAC, ELEVATORS, ETC.)								→
PLUMBING								→
ELECTRICAL DISTRIBUTION, LIGHTING, COMMUNICATION								→

Figure 4 - Organization of Technical Manuals for Rehabilitation Decision Making

needed for each attribute and would include, where available, data on structure, enclosure and division of space; mechanical systems; plumbing systems; and electrical distribution systems. This format would provide a basis for application of alternative solutions within attributes. As an example, within the health and sanitation attribute, a rehabilitated building, which could not be made to comply with natural ventilation provisions of the code, could utilize mechanical ventilation as an alternate solution. There will also be potential interrelationships between the various attributes which should be covered in the manual. As an example, the fire safety and security attributes may have conflicting technical aspects (security vs. rapid egress).

Outlines of technical manuals for the strength and stability, health and sanitation, and accident safety attributes are under development. These outlines, as well as general guidelines for application of performance-based code provisions for existing buildings, will be included in an NBS report. This includes a discussion of equivalency, application of alternate solutions, and the use of evaluation tools. A technical manual for strength and stability is now under development based on this outline.

4.2.3 Research Agenda for Building Rehabilitation

The rehabilitation of existing buildings frequently requires data on materials, components and techniques that differ significantly from those used in new construction. The initial research effort will be to identify the technological needs and to establish priorities. This research agenda will utilize information collected from regulatory officials and will be expanded to include other segments of the building community including builders, materials manufacturers, designers, etc. Specific areas to be considered include: (1) materials, components and systems; (2) application and installation procedures; (3) test methods and evaluation techniques; and (4) performance criteria. It is also anticipated that CBT will perform research on test methods as applied to the evaluation of existing construction. This work will include: (1) identification and evaluation of existing test methods, (2) modification of existing test methods, and (3) development of new test procedures.

4.3 Development of Responsive and Cost-Effective Decision Tools

4.3.1 Introduction

In many cases, those involved with building rehabilitation have limited awareness of, and access to, information needed to assure socially responsive and cost-effective decisions. Information is needed to

address: (1) user need aspects of a building which relate to the security of the occupants, safety features including means of access and egress, and "life style" considerations including comfort, convenience, privacy and aesthetics; (2) economic aspects including financial methods, cost estimation procedures, government incentives, effects of rehabilitation activity on the future value of the building, the neighborhood, etc.; (3) adaptability of a building for new uses and functions to more fully meet the current and future needs of the neighborhood; and (4) effects of rehabilitation on the neighborhood. It is necessary to consider the impacts of these factors on building occupants and users, community groups, designers, builders, investors, and financial and insurance institutions.

4.3.2 Economic Studies

It is apparent that a significant increase in the number of housing units being rehabilitated will be required if the Nation's housing needs are to be satisfied. Since costs play a vital role in all investment decisions, any significant change in current housing investment trends calls for a reduction in the uncertainty associated with the extreme cost variability of residential rehabilitation activities. A study is underway on the major cost considerations implicit in residential rehabilitation. This study will (1) assess existing cost estimating procedures and how they relate to the residential rehabilitation problem, (2) identify areas where more detailed cost information is needed, and (3) identify statistical and economic techniques which have the potential for significantly reducing the uncertainty associated with predicting the costs of residential rehabilitation.

5. Summary

The studies that form the basis of this report have provided evidence that modern building codes and standards for new building construction often cause problems when applied to rehabilitation projects for existing buildings. One such problem is an increase in rehabilitation costs, which can have the following consequences: (1) it may be more cost-effective to demolish the building and convert the land to some other use, therefore decreasing the Nation's building stock; (2) the owner may decide to do nothing and allow further deterioration of the building and the resulting detrimental effect on the neighborhood; or (3) the rehabilitation could be carried out, but the displaced occupants could no longer afford the increased rentals which must be charged to cover the financial investment.

In response to the need to support the goal of conserving the Nation's neighborhoods by encouraging the continued use of existing buildings, the Center for Building Technology is carrying out a Building Rehabilitation Technology Program. The thrusts of this program are the development of technical bases for regulations and an improved regulatory process, new technology and evaluation tools, and cost-effective decision methods.

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APPENDIX A
SELECTED PROVISIONS IN MODEL
CODES RELATIVE TO EXISTING BUILDINGS

THE BOCA BASIC BUILDING CODE - 1978 pp 3-4	THE STANDARD BUILDING CODE-1976pp 1-1,2	THE UNIFORM BUILDING CODE -- 1976 p 25
<p>SECTION 106.0 EXISTING STRUCTURES</p> <p>106.1 Application: Except as provided in this section, existing structures, when altered or repaired as herein specified, shall be made to conform to the full requirements of this code for new structures.</p> <p>106.2 Alterations exceeding 50 per cent: If alterations or repairs are made within any period of twelve (12) months, costing in excess of fifty (50) per cent of the physical value of the structure, this code's requirements for new structures shall apply.</p> <p>106.3 Damages exceeding 50 per cent: If the structure is damaged by fire or any other cause to an extent in excess of fifty (50) per cent of the physical value of the structure before the damage was incurred, this code's requirements for new structures shall apply.</p> <p>106.4 Alterations under 50 per cent: If the cost of alterations or repairs described herein is between twenty-five (25) and fifty (50) per cent of the physical value of the structure, the building official shall determine to what degree the portions so altered or repaired shall be made to conform to the requirements for new structures.</p> <p>106.5 Alterations under 25 per cent: If the cost of alterations or repairs described herein is twenty-five (25) per cent or less of the physical value of the structure, the building official shall permit the restoration of the structure to its condition previous to damage or deterioration with the same kind of materials as those of which the structure was constructed; provided that such construction does not endanger the general safety and public welfare and complies with the provisions of Section 908.2 in respect to existing roofs.</p> <p>106.6 Increase in size: If the structure is increased in floor area or number of stories, the entire structure shall be made to conform with the requirements of this code in respect to means of egress, fire safety, light and ventilation.</p> <p>106.7 Part change in use: If a portion of the structure is changed in occupancy or to a new use group, and that portion is separated from the remainder of the structure with the required vertical and horizontal fire divisions complying with the fire grading in Table 902, then the construction involved in the change shall be made to conform to the requirements for the new use and occupancy, and the existing portion shall be made to comply with the exitway requirements of this code.</p> <p>106.8 Physical value: In applying the provisions of this section, the physical value of the structure shall be determined by the building official and be based on current replacement costs.</p>	<p>101.4 — EXISTING BUILDINGS</p> <p>(a) If, within any twelve (12) month period, alterations or repairs costing in excess of fifty (50) percent of the then physical value of the building are made to an existing building, such building shall be made to conform to the requirements of this code for new buildings, also that for buildings located in fire districts the provisions of Sections 302.1 and 302.2 shall apply.</p> <p>(b) If an existing building is damaged by fire or otherwise in excess of fifty (50) percent of its then physical value before such damage is repaired, it shall be made to conform to the requirements of this code for new buildings.</p> <p>(c) If the cost of such alterations or repairs within any twelve (12) month period or the amount of such damage as referred to in paragraph (b) is more than twenty-five (25) but not more than fifty (50) percent of the then physical value of the building the portions to be altered or repaired shall be made to conform to the requirements of this code for new buildings to such extent as the Building Official may determine.</p> <p>(d) For the purpose of this section physical value of the building shall be determined by the Building Official.</p> <p>(e) If the occupancy of an existing building is entirely changed the building shall be made to conform to the requirements of this code for the new occupancy. If the occupancy of only a portion of an existing building is changed and that portion is separated from the remainder as stipulated in Section 403, then only such portion need be made to conform.</p> <p>(f) Repairs and alterations, not covered by the preceding paragraphs of this section, restoring a building to its condition previous to damage or deterioration, or altering it in conformity with the provisions of this code or in such manner as will not extend or increase an existing non-conformity or hazard, may be made with the same kind of materials as those of which the building is constructed; but not more than twenty-five (25) percent of the roof covering of a building shall be replaced in any period of twelve (12) months unless the entire roof covering is made to conform with the requirements of this code for new buildings.</p>	<p>Application to Existing Buildings</p> <p>Sec. 104. (a) General. Buildings or structures to which additions, alterations, or repairs are made shall comply with all the requirements for new buildings or structures except as specifically provided in this Section.</p> <p>(b) Construction in Fire Zones see Chapter 16.</p> <p>(c) Additions, Alterations and Repairs: More than 50 Percent. When additions, alterations, or repairs within any 12-month period exceed 50 percent of the value of an existing building or structure, such building or structure shall be made to conform to the requirements for new buildings or structures.</p> <p>(d) Additions, Alterations and Repairs: 25 to 50 Percent. Additions, alterations, and repairs exceeding 25 percent but not exceeding 50 percent of the value of an existing building or structure and complying with the requirements for new buildings or structures may be made to such building or structure within any 12-month period without making the entire building or structure comply. The new construction shall conform to the requirements of this Code for a new building of like area, height, and occupancy. Such building or structure, including new additions, shall not exceed the areas and heights specified in this Code.</p> <p>(e) Additions, Alterations and Repairs: 25 Percent or Less. Structural additions, alterations, and repairs to any portion of an existing building or structure, within any 12-month period, not exceeding 25 percent of the value of the building or structure shall comply with all of the requirements for new buildings or structures, except that minor structural additions, alterations, or repairs, when approved by the Building Official, may be made with the same material of which the building or structure is constructed. Such building or structure, including new additions, shall not exceed the areas and heights specified in this Code.</p> <p>(f) Nonstructural Alterations and Repairs: 25 Percent or Less. Alterations or repairs, not exceeding 25 percent of the value of an existing building or structure, which are nonstructural and do not affect any member or part of the building or structure having required fire resistance, may be made with the same materials of which the building or structure is constructed.</p> <p>EXCEPTION: The installation or replacement of glass in hazardous locations, as specified in Section 5406, shall be as required for new installations.</p> <p>(g) Repairs: Roof Covering. Not more than 25 percent of the roof covering of any building or structure shall be replaced in any 12-month period unless the new roof covering is made to conform to the requirements of this Code for new buildings or structures.</p>
	<p>THE NATIONAL BUILDING CODE -- 1976 p 8</p> <p>104.3. Restoration of Unsafe Building or Structure.</p> <p>A building or structure or part thereof declared unsafe by the building official may be restored to safe conditions; provided that if the damage or cost of reconstruction or restoration is in excess of 50 percent of the value of the building or structure, exclusive of foundations, such building or structures, if reconstructed or restored, shall be made to conform with respect to materials and type of construction, to the requirements of this Code; but no change of use or occupancy shall be compelled by reason of such reconstruction or restoration.</p>	

APPENDIX B

PUBLISHERS OF NATIONALLY RECOGNIZED MODEL CODES

Following is a list of major organizations and the model codes that each organization publishes. This does not constitute a complete list. Only the codes that are most widely used throughout the Nation are included.

°American Insurance Association (AIA)
85 John Street
New York, New York 10038
(212) 433-4400

Publishes:

- National Building Code

°Building Officials and Code Administrators,
International (BOCA)
17926 South Halsted
Homewood, Illinois 60430
(312) 799-2300

Publishes:

- Basic Building Code
- Basic Mechanical Code
- Basic Fire Prevention Code
- Basic Property Maintenance Code
- Basic Industrialized Dwelling Code
- Basic Energy Conservation Code
- Code Enforcement Guidelines for
Residential Rehabilitation
- Basic Plumbing Code

°Council of American Building Officials (CABO)
560 Georgetown Building
2233 Wisconsin Avenue, N.W.
Washington, D.C. 20007
(202) 333-3791

Publishes:

- MCSC List of Model Code Standards
- One and Two Family Dwelling Code

°International Association of Plumbing and
Mechanical Officials (IAPMO)
5032 Alhambra Avenue
Los Angeles, California 90032
(213) 223-1471

Publishes:

- Uniform Plumbing Code
- Uniform Solar Energy Code
- Uniform Mechanical Code (published jointly
with ICBO)

°International Conference of Building Officials (ICBO)
5360 South Workman Mill Road
Whittier, California 90601
(213) 699-0541

Publishes:

- Uniform Building Code
- Uniform Building Code Standards
- Uniform Mechanical Code (published jointly with
IAPMO)
- Uniform Fire Code
- Uniform Sign Code
- Uniform Code for the Abatement of Dangerous
Buildings Analysis of Revisions
- Uniform Housing Code

°National Fire Protection Association (NFPA)
470 Atlantic Avenue
Boston, Massachusetts 02210
(617) 482-8755

Publishes:

- National Electrical Code
- Electric Code for One- and Two-Family Dwellings

°Southern Building Code Congress, International (SBCC)
900 Montclair Road
Birmingham, Alabama 35213
(205) 591-1853

Publishes:

- Standard Building Code
- Standard Mechanical Code
- Standard Plumbing Code
- Standard Fire Prevention Code
- Standard Gas Code
- Standard Housing Code

°National Association of Plumbing-Heating-Cooling
Contractors
1016 - 20th Street, NW.
Washington, D.C. 20036
(202) 331-7675

Publishes:

- National Standard Plumbing Code (co-sponsored
by the American Society of Plumbing Engineers)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET		1. PUBLICATION OR REPORT NO. NBS TN 998	2. Gov't. Accession No.	3. Recipient's Accession No.
4. TITLE AND SUBTITLE Impact of Building Regulations on Rehabilitation -- Status and Technical Needs			5. Publication Date May 1979	
			6. Performing Organization Code	
7. AUTHOR(S) James G. Cross, James H. Pielert, and Patrick W. Cooke			8. Performing Organ. Report No.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, DC 20234			10. Project/Task/Work Unit No. 7443112	
			11. Contract/Grant No.	
12. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)			13. Type of Report & Period Covered	
			14. Sponsoring Agency Code	
15. SUPPLEMENTARY NOTES <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.				
16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.) This report presents the results of a study of the impact of regulations on building rehabilitation and includes a discussion of the activities of the Building Rehabilitation Technology Program of the Center for Building Technology. Particular activities discussed relative to existing buildings include: (a) development of the technical bases for regulations and an improved regulatory process, (b) development of new technology and evaluation tools, and (c) development of responsive and cost-effective decision tools. A new code concept is outlined which could be a replacement for the "25-50 percent" rule presently in codes for new construction. This rule often controls the amount of work that may be required in the rehabilitation of existing buildings. The status of existing code documents for building rehabilitation is provided along with an overview of other publications which discuss the impact of building regulations on rehabilitation.				
17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons) Building code; building research; code administration; existing buildings; model codes; preservation; regulation; rehabilitation; renovation.				
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Note: The Journal was formerly published in two sections: Section A "Physics and Chemistry" and Section B "Mathematical Sciences."

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Annual subscription: Domestic, \$11.00; Foreign \$13.75

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NOTE: At present the principal publication outlet for these data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St. N.W., Wash., D.C. 20056.

Building Science Series—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

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Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

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